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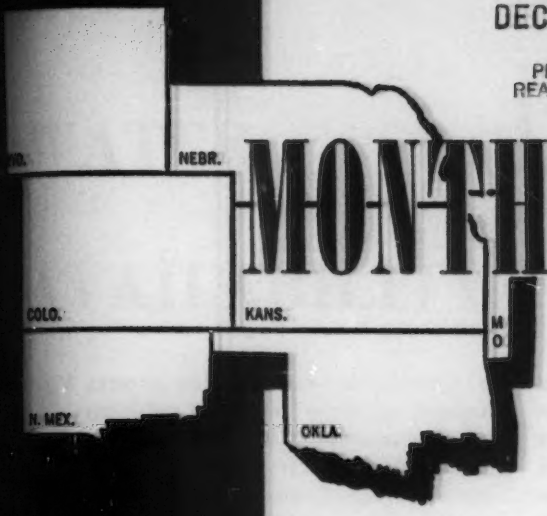

MONTHLY REVIEW

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WATER AVAILABILITY

A National Problem?

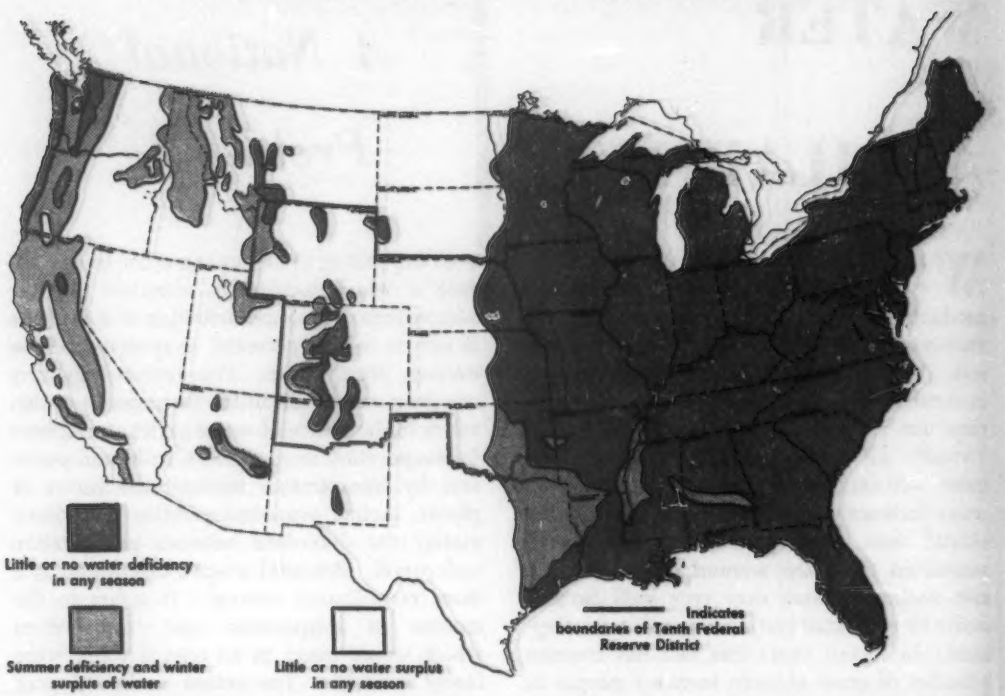
WATER IS, either directly or indirectly, a crucially important input in modern productive processes. Some economic activities—such as irrigation farming, petro-chemicals production, and mining—require huge quantities of water directly, very much as they use materials or fuel as input factors. Virtually all other productive activities require vast—and ever growing—quantities of water indirectly in various domestic and municipal uses. It is apparent, therefore, that limitations upon the amount of water available within an area may very well circumscribe its economic and demographic development. In recent years this fact has become a matter of great concern to many people in this country and especially to those residing in the arid and semi-arid states of the West. If certain, relatively small, humid islands created by the high mountain ranges of the West are disregarded, it is correct to say that approximately the western half of this country has an average annual precipitation of less than 20 inches. More than one half of the Tenth Federal Reserve District lies in this low rainfall area.

However, the mere statement that less than a given number of inches of precipitation occurs in a certain area, without some other sort of referent, does not indicate whether the term "dry" may meaningfully be applied to an area. This is true because the adequacy of a given number of inches of moisture for various economic purposes will vary greatly from area to area depending upon, among other things, the rate at which moisture is absorbed into the atmosphere. Thus, one definition of a dry area is one in which potential evapotranspiration exceeds precipitation. This terminology may require some clarification. Evapotranspiration refers to the return of water to the atmosphere by evaporation from streams, soils, and ponds and by transpiration through the leaves of plants. Actual evapotranspiration is approximately the difference between precipitation and runoff. Potential evapotranspiration is a more complicated concept. It refers to the amount of evaporation and transpiration which would occur in an area if water were freely available. The actual transmission of water into the atmosphere from a heavily irrigated desert area approaches its potential evapotranspiration.[1]

According to this definition, over one half of the United States and all of the District with the exception of the eastern portions of Nebraska, Kansas, and Oklahoma, the portion of Missouri lying in the District, and limited high altitude areas in other states would be classified as having a dry climate. This fact is easily forgotten during periods when the rainfall cycle is in its upward phase and water appears plentiful. It becomes painfully evident, however, when the cycle turns downward as it has done with depressing regularity

[1] *See Thornthwaite, C. W., "An Approach Toward a Rational Classification of Climate,"* GEOGRAPHICAL REVIEW, *Vol. 38, 1948.*

WET AND DRY AREAS OF THE UNITED STATES
The Relation of Precipitation to Potential Evapotranspiration


Little or no water deficiency in any season
Summer deficiency and winter surplus of water
Little or no water surplus in any season
Indicates boundaries of Tenth Federal Reserve District

SOURCE: Thornthwaite, C. W., "An Approach Toward a Rational Classification of Climate," *Geographical Review*, Vol. 38, January 1948. (Copyright 1948, American Geographical Society of New York.)

ever since the area was first settled. Problems of water shortage and issues concerning water conservation thus have a special immediacy to this District which spans the western Great Plains, termed by early historians of the area "The Great American Desert." Some of the problems concerning water use which occur in an area such as this are: (1) Does there appear to be reason to expect a limitation to economic development due to water shortage and how immediate is this limitation? (2) Is the structure of the economy evolving in a fashion which tends to make it more water using or less water using? (3) What uses of water would tend to yield the largest production for the area? (4) What uses of water would tend to be most effective in absorbing the potential population of the area? A beginning toward an answer to the first question is made in this article by reviewing some of the evidence concerning the water problem as it confronts the United States. Attention will be directed specifically to the problems of the District in forthcoming issues of the *Review*.

The Water Problem in the United States

The problem of water shortage as it may confront the United States in the foreseeable future is dealt with very briefly here, largely because only severely circumscribed conclu-

sions can be drawn from a consideration of the entire country as an aggregate. The United States is so dissimilar in its rainfall and streamflow pattern as between different regions that a regional approach to the water problem is highly desirable. A generalized comparison of total water available to the United States and total requirements neglects the fact that unused runoff from certain basins (such as the Columbia) is almost bound to coexist with great stringency in the water supply elsewhere (such as in the Rio Grande Basin). Nevertheless, in a country with high labor and capital mobility such as the United States, an over-all comparison is of some relevance and some of the concepts developed here will be useful later for a regional approach to the problem.

Rainfall in the United States

Considering the size of the land mass involved, the United States is relatively well endowed with water resources. A study made of the annual runoff from the various land areas of the world indicates that the water supplies of South and North America are potentially greater than in other continental areas.[2] This is reflected in the fact that by the definition adopted above, approximately one half of the land area of the United States is wet, i.e., precipitation exceeds potential evapotranspiration. The average annual precipitation over the entire land area of the United States is about 30 inches, which is equivalent to about 4,300 billion gallons of water daily.

As has been suggested earlier, however, great variation exists in the rainfall pattern both on a monthly and geographical basis. The highest average annual precipitation recorded within the continental United States is 150.73 inches at Wynoochee, Washington, while the lowest is 1.66 inches at Greenland Ranch, California. Similarly, striking local variations in rainfall occur from year to year. Nevertheless, there is little evidence to indicate that the average annual precipitation falling on the land area of the United States is either increasing or decreasing over time. It is this precipitation upon which we must ultimately depend as the source of our sustainable water supply.

Underground Water and the Sustainable Water Supply

It will, of course, occur to the reader that underground water offers a large additional supply. The huge underground reservoirs which have been filled through the centuries and which underlie large areas of the United States do, in fact, contain vast quantities of water. Although inventories of ground water unfortunately are very incomplete, it has been estimated that these reservoirs now hold more water than the combined capacities of all lakes and surface reservoirs.[3] Nevertheless, the aquifers, or water-bearing strata, of these reservoirs are ultimately completely dependent upon rainfall for their recharge. If water is pumped from these reservoirs at a rate greater than their rate of recharge, "mining" of water occurs and the water table falls continuously. However, a falling water table does not necessarily indicate that water is being mined. In some cases, withdrawal may exceed recharge during drought periods and the situation be reversed during wet periods so that no mining takes place over the course of a rainfall cycle. Again the water bearing strata may be comparatively impermeable so that water moves through it relatively slowly. Under these conditions the water table will tend to fall in the wells after pumping com-

[2] *See Langbein, W. L., and others, "Annual Runoff in the United States," U. S. Geological Survey Circular 52, June 1949.*

[3] *Thomas, H. E.,* The Conservation of Ground Water, *1951, p. 28. A comprehensive discussion of ground water supplies and problems in the United States is found in this book.*

mences but will tend to stabilize at a lower level as more water is induced to enter the pumping area, if the rate of withdrawal does not exceed the rate of recharge for the reservoir as a whole. Also, since the normal flow of a stream constitutes the overflow of a subterranean aquifer, pumping from wells may do nothing more than deplete the surface flow from the reservoir without continuously lowering the water table.

In fact, however, a number of areas already exist in the United States where serious and sustained depletion of the water stored in underground aquifers has taken place. The most important of these areas are in the Central and San Joaquin Valleys of California, southcentral Arizona, the High Plains of northwestern Texas and eastern New Mexico, and a relatively smaller area in eastern Arkansas. Probably the most notable of these areas are the San Joaquin Valley of California and the High Plains of Texas. An estimate made several years ago indicated that in the San Joaquin Valley alone, some 40,000 wells produce over 6 billion gallons of water per day (about one fifth of all the ground water used in the Nation) with a daily overdraft in excess of 1 billion gallons. In the High Plains of Texas, the rate of withdrawal has been perhaps 25 times the rate of recharge. The total overdraft in the Southwest has been estimated to be approximately 5 billion gallons per day. If these areas of overdraft continue their current rates of underground water use, their economic development most assuredly will be adversely affected at some future time. Remedial measures to help balance draft against recharge have been taken in some areas. Such measures include spreading storm waters in recharge areas and pumping surface water into the aquifers through recharge wells. These techniques have been especially important in California and New York where actual or threatened incursion of saline—or salty—waters into aquifers has become a problem due to the lowering of water tables. Nevertheless, these measures are expensive and of limited efficacy.

It may be argued, however, that reasons similar to those given for mining our limited stocks of petroleum and other minerals could be used to justify the mining of water. Here, as in the case of other resources, we might rely upon developing technology to find substitutes or augment our supply. But it is important in this regard to note the monstrous quantities of water which our current standard of living requires. It is estimated that the annual average water use per person in the United States is about 1,500 tons. By contrast, the use of all other materials, such as food, fuel, metals, plastics, lumber, sand and gravel, etc., amounts to a mere 18 tons. Thus, even if an efficient means of desalineating sea water were to become economically feasible in this country, tremendously high transportation costs would still exist to areas far inland where large water deficits occur. The population of such areas presumably would need to become accustomed to radically different habits of water use than currently exist in the United States and water-using productive processes would undoubtedly be inhibited.

The amount of water which finds its way into the oceans by means of streamflow, therefore, is a good first approximation of the maximum permanently sustainable fresh water supply. Needless to say, this supply may be tapped at points either above or below the earth's surface. The difference between the amount of water deposited annually and total discharge from streams is accounted for primarily by natural evapotranspiration and consumptive use of water. The idea of evapotranspiration has been explained earlier in the article but the notion of consumptive use must now be explored briefly.

Consumptive Uses of Water

A consumptive use of water is one which actually precludes, through evapotranspira-

tion or embodiment in a product, the use of that water by potential successive users. Consumptive use is distinguished from withdrawal, or diversion, which indicates the gross amount of water used as an input in some process. This concept of consumption is necessarily somewhat fuzzy, especially when applied to large land masses. Consumptive uses involve such activities as irrigation, rural and urban domestic water use, industrial and commercial water use, and steam electric power. Uses of water for navigation, flood control, hydrogeneration of electric power, and recreation are usually not considered consumptive, although it should be noted that, to the extent that these uses require reservoir storage, some amount of evaporation should legitimately be attributed to them. Irrigation is probably the most consumptive of the major uses of water. It has been estimated that 20 to 60 per cent of the water used in irrigation constitutes return flow, either by seepage into streams or percolation into aquifers. The proportion of the water diverted for irrigation purposes which does appear as return flow depends largely upon the rate of potential evapotranspiration in the area where the irrigation occurs. On the other hand, as much as 95 per cent of municipal and industrial water reaches streams as sewage effluent. However, consumptive losses of municipal and industrial water ordinarily constitute a larger proportion of withdrawal in areas of water shortage than elsewhere because a larger proportion is used for cooling purposes and watering lawns.

Water Supply and Consumptive Use

As stated earlier, an average of approximately 4,300 billion gallons of water is deposited upon the United States daily.[4] Nearly 75 per cent of this precipitation is returned to the atmosphere by the process of evapotranspiration. Much of this return to the atmosphere occurs through transpiration of plants and direct evaporation from bodies of water or moist earth. An additional large amount is lost due to various consumptive uses of water. Streamflow measurements of the Federal Geological Survey indicate that slightly in excess of 8 inches of the 30 inches average annual rainfall flows into the oceans through streams. This is the equivalent of about 1,145 billion gallons of water per day. This estimated quantity represents the maximum potential supply over and above current consumption and is equal to over four times the estimated total withdrawal—not consumption—for all irrigational, industrial, and municipal purposes in 1955.

Unfortunately, not all of this potential water supply can be realized. The greatest limitation occurs due to the fact that almost two thirds of this streamflow is discharged into the oceans by streams at flood stage during comparatively short periods of time. Thus, according to the estimates of the U. S. Department of Commerce, less than one third of this total streamflow is available during the greater part of the year. Consequently, use of this potential supply of water on a large scale is heavily dependent upon adequate storage facilities and a carefully regulated release of the flood water accumulated in them. It has been estimated that, by providing greater storage capacity to supplement the currently available dependable streamflow, it would be economically possible to provide future constant availability of 630 billion gallons daily of acceptable quality water, or approximately one half of the measured total runoff. It is further estimated that probably half of this amount would have to be reserved for navigation and for the disposal of industrial and domestic wastes. This would leave a residual amount of about 315 billion gal-

[4] *Unless otherwise indicated, the figures on water availability and water use in the United States found in the next few paragraphs are from the U. S. Department of Commerce,* Business Service Bulletin No. 136.

lons daily for consumption in irrigation, domestic, industrial, and farm uses, as compared with a present estimated consumption of about 115 billion gallons daily by those uses. If the present pattern of use and extent of reuse continues, total consumption by 1975 will reach a daily average of about 170 billion gallons.

On the face of it, this result appears very optimistic. It must be remembered, however, that the usefulness of a highly aggregative approach to a problem such as this is severely limited. The geographical structure of the water supply may be of such a nature as to conflict with social goals such as the diversification of industry, residence in climates offering superior amenities of life, and regional development. Obtaining water will also necessarily become more expensive as the limits of potential supply are approached and gathering problems become more severe. Also, the notion of consumption, as it is used in this article, does not take into account the heavily polluted nature of much of the water discharged by industrial and domestic users, because sewage effluent discharged into the Nation's streams almost necessarily re-enters the available water supply. Nevertheless, industry faces severe waste disposal problems in certain areas and there is considerable social cost involved in turning many of the Nation's rivers into open sewers.

Concluding Comment

When judged on the basis of aggregate supply and use data, it would appear that the water problem for the Nation as a whole is not severe. As has been pointed out, however, this approach neglects serious problems involved in the geographical distribution of water supplies. One example of this is the shortage of municipal and industrial water which has already manifested itself in a number of cities and led them to reach long distances for additional supplies. As is well known, Los Angeles obtains its city water (except for a relatively small amount coming from local wells) by means of aqueducts reaching across the breadth of California, and New York City obtains its supply (again with the exception of a small amount coming from local wells) from aqueducts extending into upper New York state. In the District states, Denver has found it necessary to tunnel through the mountains to the western slope of the Rockies for part of its water supply. Also a canal reaching southeast from Oklahoma City, which would carry water to that city from three reservoirs in southeastern Oklahoma, has been proposed. As the population of the District increases, other cities may face a similar situation. A more comprehensive discussion of the District water supply and its possible future effects on economic development in the area will appear in a future issue of the *Review*.

The Sheep Industry—

Trends and Prospects

ALTHOUGH SHEEP NUMBERS declined to the lowest levels on record during the 1940's, the sheep industry remains relatively important in many parts of the Tenth Federal Reserve District. Numbers have remained relatively stable since 1950 and current indications are that some expansion is occurring. Analysis of the factors affecting the sheep industry since World War II is helpful in interpreting the forces influencing the current expansionary phase, and the degree and duration of expansion will be determined largely by many of the same factors.

Importance of Sheep Production

On January 1, 1958, there were 31 million head of sheep and lambs in the Nation. One fourth of them were on District farms and ranches. Of the 7.7 million head of sheep and lambs in the District, 6.2 million head were stock sheep and lambs in commercial breeding flocks, while 1.5 million head were sheep and lambs being fed for marketing as slaughter animals. The Tenth District had 23 per cent of the stock sheep and 38 per cent of the sheep and lambs on feed in the Nation.

Among the states, Wyoming, Colorado, and New Mexico ranked second, sixth, and eighth, respectively, in the number of stock sheep and lambs. Colorado was first and Nebraska second in the number of sheep and lambs on feed, and nearly one fourth of all sheep and lambs in the Nation were being fed in these two states.

Cash receipts from the sale of sheep, lambs, and wool were fifth as a source of income from livestock enterprises in District states. In 1957, District farmers and ranchers received $126 million from the sale of these products. Wyoming farmers received one fifth of their cash receipts from the sale of sheep, lambs, and wool, while Colorado and New Mexico farmers received 7 and 6 per cent, respectively. Farmers in each of the other four District states received 2 per cent or less of their cash receipts from sheep enterprises.

Characteristics of Sheep Production

Sheep production in the United States is divided into two general areas—western and native. The western area is composed of 13 states, including Texas and South Dakota, as well as the Mountain and Pacific states. All other states are considered as producing native sheep. Thus, among District states, Colorado, New Mexico, and Wyoming produce western sheep, while Kansas, Missouri, Nebraska, and Oklahoma produce native sheep.

As indicated previously, sheep are relatively more important to agriculture in the Mountain states of this District. Production in the Mountain states has been characterized by large flocks of ewes grazed on open ranges. In this system, sheep were produced on specialized ranches and highly skilled herders were required to care for them. Under this system of production, western sheep were

noted for their production of a heavy, high-quality fleece. Recently, there is evidence that small- and medium-sized flocks have tended to increase in importance in the western states and more emphasis has been placed on breeding the larger, mutton-type sheep. Irrigated farms and the shortage of skilled labor have caused the increase in the number of farm-sized flocks, while interest in the mutton type has expanded as income from wool production has become relatively less important.

Native sheep producing states in the District are generally characterized by small flocks of mutton-type breeds. The sheep enterprise usually is only a small part of the total farm business on most farms in native states, and specialized sheep production units are uncommon. Of the farms in District states reporting sheep in the 1954 Census of Agriculture, the four native sheep producing states reported an average of 33 head of sheep over 1 year of age per farm, while the three Mountain states reported an average of 311 sheep per farm or ranch. Most native sheep producers fatten and sell for slaughter the lambs they produce, whereas in the Mountain states, producers more often sell their lambs as feeder stock.

Lamb feeding also is an important agricultural enterprise in parts of both the native and western sheep areas of the Tenth District. Colorado is the only Mountain state in the District that feeds a large proportion of the lambs it produces. New Mexico and Wyoming farmers produce relatively little grain and do not fatten many of the lambs they produce, although both states do feed some lambs in irrigated areas. Nebraska is the leading native sheep producing state in the District in the number of lambs fed. The sugar beet areas of both Colorado and Nebraska are relatively important feeding areas. Fall wheat pasture provides another common method of feeding lambs in the District. Large numbers of lambs are pastured on wheat when such pasture is available in District states.

Decline in Sheep Numbers

Estimates of the number of sheep and lambs on the Nation's farms at the beginning of the year have been made each year since 1867. Recent reports on numbers of sheep and lambs on farms have been divided into stock sheep and lambs, and sheep and lambs on feed. Stock sheep and lamb numbers are more useful for indicating trends in the sheep industry than are total sheep numbers. Numbers of sheep and lambs on feed are more useful as an indicator of marketings for slaughter in the immediate future.

On January 1, 1942, there were over 49 million head of stock sheep and lambs on farms, an amount exceeded only in 1883, 1884, and 1885. On January 1, 1958, only 27.4 million head of stock sheep and lambs were on the Nation's farms—45 per cent less than in 1942. All of the decline occurred between 1942 and 1950, with the most rapid rate of decline occurring from 1943 to 1947 when flocks were reduced 4 to 5 million head each year. Stock sheep numbers decreased another 5 million head from 1947 to 1950. Slightly over 26 million head of stock sheep were on the Nation's farms on January 1, 1950.

Both the western and native sheep producing areas had declines at nearly equal rates during the 1942-50 period. Stock sheep numbers declined by 46 per cent for the western sheep area and by 49 per cent for the native sheep area. Numbers decreased by only 43 per cent in the Tenth District during the same period, but continued to decrease through 1950 when numbers increased nationally.

Several factors contributed to the decline in sheep numbers. The labor shortage during the war and postwar periods was a major factor, especially in states where large flocks are grazed on open ranges. Highly skilled herders are necessary to care for the range

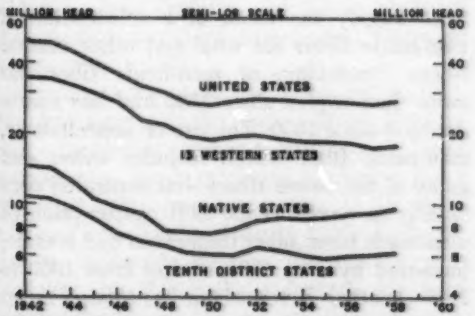
flocks. This is often an unpleasant type of work, and attractive opportunities for off-farm employment caused a shortage of herders.

During much of the period when sheep numbers were declining, many other livestock and crop enterprises offered more profitable alternatives which encouraged resources to be shifted away from sheep production. Beef cattle herds, in particular, competed with sheep flocks for resources and, since cattle tended to be more profitable and to require less labor, grazing resources frequently were shifted from sheep to cattle production.

Developments Since 1950

The steady decline of stock sheep numbers which began in 1942 ended by January 1, 1950, and, during the next two years, sheep numbers increased 7 per cent to 28 million head--the peak since 1950. After January 1, 1952, sheep numbers remained relatively stable at slightly over 27 million head, except in 1956 when numbers dropped to 26.5 million head. On January 1, 1958, stock sheep numbers were 5 per cent above the low on January 1, 1950.

STOCK SHEEP AND LAMBS ON FARMS, JANUARY 1, 1942-58



NOTE: On a semi-logarithmic scale, equal slopes indicate equal rates of change.
SOURCE: U. S. Department of Agriculture.

Both western and native sheep production increased from 1950 until 1952, but since then, production in the western sheep area has declined while production in the native sheep area has continued to increase. From 1950 to 1958, there was an over-all decline of 5 per cent in the western sheep area as compared with an increase of 28 per cent in the native sheep area. The 13 western states still have the largest proportion of the sheep in the United States, but the proportion declined from 72 per cent of the Nation's total in 1950 to 65 per cent in 1958. Factors contributing to the continued decline in western sheep production were the drought affecting much of the area during the mid-1950's and the persisting shortage of skilled labor required to care for range flocks. Native production rose in response to increased profit opportunities in more recent years when farmers sought to increase their returns as farm income declined. Sheep production can be expanded with relatively low capital requirements, and quick returns on the investment can be expected because of the short time required to expand production.

In the Tenth District, the 1958 inventory of stock sheep was only 2 per cent above the 1950 level. Stock sheep numbers have exceeded the 1950 inventory in only three recent years. From 1954 to 1957, sheep numbers in the District were very low because of the severe drought which reduced pasture and feed supplies.

Although stock sheep numbers for the District changed but little after 1950, there was considerable variation by individual states. Numbers increased as much as 97 per cent in Oklahoma and decreased as much as 28 per cent in Missouri. During the same period, Kansas and Nebraska had increases of 43 and 83 per cent, respectively. In District Mountain states, sheep numbers in New Mexico declined 13 per cent, while increasing by 5 per cent in Colorado and 7 per cent in Wyoming.

District Mountain states showed a small increase as compared with a 5 per cent decline in sheep numbers for the Western states as a whole during the same years.

Lamb Feeding Trends

Lamb feeding declined at equal rates for both the Nation and District from 1942 to 1951. Tenth District farmers had an average of 45 per cent of the Nation's January 1 number of sheep and lambs on feed during the period 1942-52. After 1952, the drought restricted pastures and feed supplies in the Tenth District, resulting in a decrease in lamb feeding while numbers fed nationally increased. The proportion fed in the District declined from 45 per cent to 38 per cent in the years after 1952. The January 1, 1956, and 1957 inventories of sheep and lambs on feed in District states were only 35 per cent of the national numbers. Feed production in the Tenth District was very low in 1955 and 1956. The January 1, 1958, numbers declined slightly from 1957 for the District, while a 9 per cent decline occurred for the Nation. In 1957, higher slaughter lamb prices increased profits from sheep enterprises and better moisture conditions in the range states improved pastures substantially. These two factors induced farmers and ranchers to retain lambs for enlargement of their breeding flocks and resulted in a decline in the number of sheep and lambs on feed on January 1, 1958.

The Tenth District did not share in the sharp 1958 decline, primarily because of a large increase in numbers of lambs on feed in Kansas. Large numbers of lambs are usually fed on wheat pasture in Kansas, but during the drought years there was little wheat pasture and the numbers fed were reduced sharply. The greatly improved condition of wheat in the fall of 1957 encouraged Kansas farmers to purchase large numbers of feeder livestock to utilize the available pasture, resulting in a 64 per cent increase in sheep and lambs being fed on January 1, 1958. New Mexico and Wyoming had small increases in the number of sheep and lambs on feed during 1957, while Colorado and Nebraska had substantial decreases and Missouri and Oklahoma had small decreases.

Wool Production and Consumption

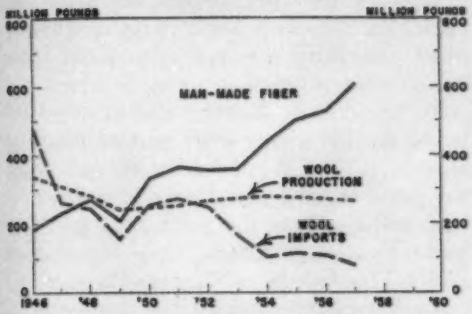
In recent years, only about one fourth of the cash receipts from sheep has been from the sale of wool. Since wool production is a secondary source of income, factors affecting the production of lamb and mutton influence wool production more than the factors directly affecting the consumption of wool.

Since 1950, wool production in the United States has increased with the increase in numbers of stock sheep, although demand for wool has declined. Between 1950 and 1957, production of apparel wool increased 7 per cent, while mill consumption of apparel wool dropped 45 per cent. This decline in wool consumption resulted in a decrease of more than two thirds in wool imports. Mill consumption of wool in the United States during 1957 was the smallest for any year since 1938.

The low level of wool consumption in 1957 was partly caused by a general decline in textile activity. Mill use of all major fibers except noncellulosic, man-made fiber declined in 1957. However, the decline in wool use has been largely the result of a substitution of man-made fibers for wool and other natural fibers. Production of man-made fiber has more than tripled since 1946 and has nearly doubled since 1950. The use of noncellulosic, man-made fiber—which includes nylon and many of the newer fibers—has expanded very rapidly in recent years. Mill consumption of man-made fiber, other than rayon and acetate, increased by over 400 per cent from 1950 to 1957. Another factor which has tended to reduce the Nation's wool consumption is the trend to lighter-weight and more informal clothing by Americans in recent years

APPAREL WOOL PRODUCTION, IMPORTS, AND MAN-MADE FIBER PRODUCTION

United States



SOURCE: U. S. Department of Agriculture.

World wool production and consumption increased 25 per cent from 1950 to 1957, while United States wool production rose slightly and consumption dropped sharply. Increasing population and improved living standards have tended to increase world demand for wool. Other areas do not have the widespread central heating and automobile transportation that have contributed to the trend toward lighter-weight clothing in the United States. The United States has dropped from third in wool production in 1945 to sixth in 1957. Only Australia and Argentina exceeded the United States in wool production in 1945, while the U.S.S.R., New Zealand, and Union of South Africa also surpassed the United States in production in 1957.

Since enactment of the Wool Act of 1954, wool producers in the United States have received incentive payments to encourage wool production. Each producer is eligible for a payment based on a percentage of the value of wool sold. The percentage applied is based on the difference between the average price received by the Nation's farmers for wool during the marketing year and the previously established incentive level, which is determined by the Secretary of Agriculture. The payments are made in the summer following the end of the marketing year in April. Funds for the incentive payments are obtained through tariff collections on wool imports. Prior to the 1954 Act, wool prices were supported by Commodity Credit Corporation loans and purchases. The last of the CCC storage holdings of wool were sold early in 1958. The market price of wool in the United States has followed world wool prices closely since the Wool Act was adopted.

The Wool Act, which was scheduled to expire at the end of the present marketing year, was extended for 3 years in the last session of Congress. The new law is very similar to the old one, but increases the amount of funds used to make the incentive payments.

Situation and Outlook

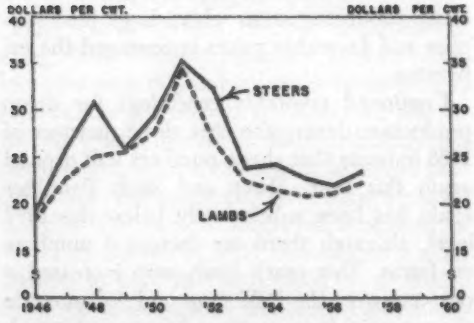
A combination of improved prices, low feed costs, and improved pasture and range conditions during 1957 has induced farmers and ranchers to increase the size and number of sheep flocks. Sheep and lamb slaughter in 1957 was the smallest since 1952, as animals were held back for breeding purposes. In the 13 western states, the first increase in stock sheep numbers since 1952 occurred. Improved range conditions following the breaking of the drought probably were the most influential factors causing this increase. Stock sheep numbers continued to increase in the native sheep producing areas where large feed supplies and favorable prices encouraged the expansion.

Continued favorable conditions for sheep production during the first three quarters of 1958 indicate that sheep numbers will expand again this year. Sheep and lamb slaughter again has been substantially below the 1957 level, although there are increased numbers on farms. This year's lamb crop increased 4 per cent over the 1957 crop and will provide the potential for a continued increase in stock

sheep numbers. The size of increase will depend on the proportion of the lamb crop that is held back for breeding purposes. Producers usually tend to hold back a larger proportion of the lamb crop when conditions are as favorable as they have been in recent months, which indicates that a relatively large increase in sheep numbers may occur this year.

Several factors will influence the size and duration of the present increase that is occurring in sheep numbers. Expansion in the western states tends to be retarded by the limited availability of the specialized labor necessary to care for the large range flocks. However, the apparent trend toward increasing the number of small- and medium-sized flocks as supplementary enterprises will tend to increase sheep numbers in western states. Also, the condition of ranges and competition of beef cattle for rangeland will influence flock expansion. Beef cattle and sheep compete directly for use of range resources. Beef cattle require relatively less labor and thus are preferred by many western livestock producers. On the other hand, sheep require less initial capital and can be expanded more rapidly.

AVERAGE YEARLY PRICE PER HUNDREDWEIGHT OF LAMBS AND STEERS
All Grades, Chicago



SOURCE: U. S. Department of Agriculture.

Sheep producers in the native states are likely to be influenced primarily by the profitability of the enterprise in relation to alternatives when they are considering expansion plans. Farm flocks in these states usually are small and cared for with the same labor sources that are used for other livestock and crop production. Furthermore, sheep and lambs provide a very small part of the total meat supplies of the United States and, thus, the price of other meat animals—especially beef cattle—affects the price of sheep and lambs to a large extent. Since the end of World War II, the average yearly price of lambs has closely followed the average price of steers. Thus, developments in the beef cattle industry will influence the decisions made by sheep producers in the native states.

Another factor also could limit the expansion of the sheep industry. The decline in sheep numbers resulted in a decrease in the annual per capita consumption of lamb and mutton from 7 to 4 pounds. Per capita consumption has averaged only slightly over 4 pounds during the 1950's. Consumer tastes probably have been influenced and it is doubtful that per capita consumption could again be expanded by any substantial amount without sharply reduced prices. Such a reduction in price would tend to make sheep production less profitable and would limit the amount of expansion.

Producers recently have received one quarter of their income from the sale of wool. Thus, income from wool is important enough to influence the decisions made concerning the sheep enterprise. Under the Wool Act of 1954, payments have been made to wool producers that insure an average annual price of 62 cents per pound for wool. This type of support will be continued for the next 3 years, since the Wool Act has been extended for that period. With a favorable price for wool assured by the incentive payments, producers will be encouraged to expand their flocks.

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Crop Production—Response to Acreage Control (6 pages)	September
District Farm Income—On the Road to Recovery (6 pages)	July
Financing the Expansion in Farm Debt (6 pages)	April
Grazing is Big Business in the Tenth District (7 pages)	February
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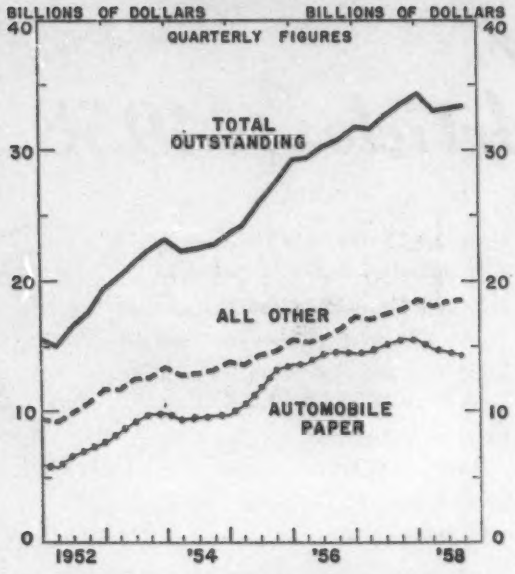
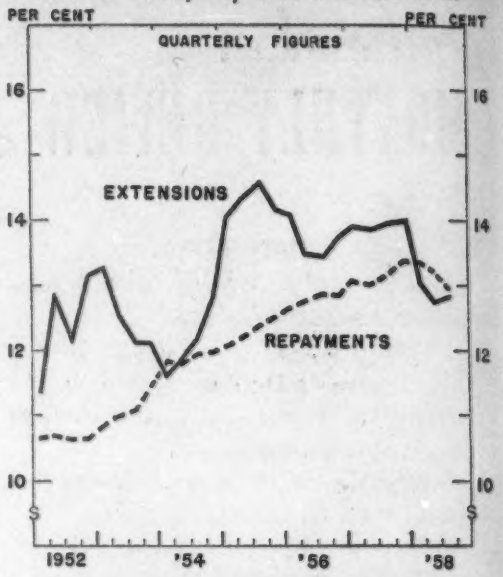
CONSUMER INSTALMENT CREDIT IN THE UNITED STATES

Outstanding



Extensions and Repayments

As a Per Cent of Disposable Personal Income



BANKING IN THE TENTH DISTRICT

District and States	Loans		Deposits	
	Reserve City Member Banks	Country Member Banks	Reserve City Member Banks	Country Member Banks
	October 1958 Percentage Change From			
	Sept. 1958	Oct. 1957	Sept. 1958	Oct. 1957	Sept. 1958	Oct. 1957	Sept. 1958	Oct. 1957
Tenth F.R.Dist.	+1	+6	†	+17	−1	+10	+2	+11
Colorado	+2	+14	+1	+17	+1	+13	†	+11
Kansas	−1	+11	−1	+25	−2	+9	+1	+11
Missouri*	+2	+3	+1	+7	−2	+9	+1	+12
Nebraska	+7	+13	+5	+19	−2	+7	+1	+10
New Mexico*	**	**	−5	+8	**	**	+5	+11
Oklahoma*	−3	−1	−2	+16	−2	+11	+1	+11
Wyoming	**	**	−2	+16	**	**	+6	+11

*Tenth District portion only. **No reserve cities in this state.
†Less than 0.5 per cent.

PRICE INDEXES, UNITED STATES

Index	Oct. 1958	Sept. 1958	Oct. 1957
Consumer Price Index (1947-49=100)	123.7	123.7	121.1
Wholesale Price Index (1947-49=100)	119.0	119.1	117.8
Prices Rec'd by Farmers (1910-14=100)	252	258	241 r
Prices Paid by Farmers (1910-14=100)	307	305	296

r Revised.

TENTH DISTRICT BUSINESS INDICATORS

District and Principal Metropolitan Areas	Value of Check Payments		Value of Department Store Sales		*Value of Residential Building Permits	
	Percentage change—1958 from 1957					
	Oct.	Year to date	Oct.	Year to date	Oct.	Year to date
Tenth F. R. Dist.	+8	+4	+6	+2	+68	+34
Denver	+10	+7	+6	+4‡	−27	−1
Wichita	0	+5	−1	−4	+57	−4
Kansas City	+12	+5	+8	0	+163†	+102†
Omaha	+14	+7	+8	+3	+51	+24
Okla. City	+2	−3	+1	0	+83	+22
Tulsa	+2	−5	+16	+11	+12	+67

*City only. †Kansas City, Mo., and Kans. ‡Percentage changes not previously available: August +5, September +6.

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